AN ABSTRACT OF THE DISSERTATION OF

Debra Lynn Patterson for the degree of Doctor of Philosophy in Human Performance presented on April 21, 2000. Title: Distant Interactions and Their Effects on Children's Physical Activity Levels During Fitness Instruction.

Abstract approved: Redacted for Privacy

Hans van der Mars

Evidence exists that links a sedentary lifestyle with the emergence of chronic diseases during adulthood. Reports indicate that many children and adolescents already have risk factors for chronic diseases and the prevalence of obesity among children is at an all time high. There are concerns that children may not be active enough for current or future health benefits. It is imperative that elementary physical education teachers provide effective instruction during health-related fitness instruction since physical activity patterns are believed to be established during childhood. A central dimension of teachers' instruction involves active monitoring of students' performance and conduct. This study sought to determine a functional relationship between distant interactions (a component of active monitoring) by physical education teachers and elementary students' moderate to vigorous physical activity (MVPA) levels during fitness instruction. Distant interactions were defined as teachers' verbal prompts, encouragement, and feedback provided to students located on opposite ends of the gym from where the teacher is located. Five classes (grades 3-5) and two elementary physical education teachers were observed for this study. A reversal design using two treatments, close interaction (C-IA) and distant interaction (D-IA) over multiple phases was implemented. A modified System for Observing Fitness Instruction Time (SOFIT) and "live"

momentary time sampling was used to measure students' MVPA during fitness instruction. Teachers' interactions were coded using SOFIT's teacher behavior categories. Fidelity of treatment was assessed. Students' mean MVPA levels and teacher interaction behavior data were graphed and analyzed visually. Interobserver agreement checks were completed for all groups across all conditions. The results indicated the use of distant interaction increased the MVPA levels for the students farthest from the teacher while the close students maintained their levels. Findings build further the empirical base of teachers' active monitoring behavior and point to the importance of teachers distributing their attention to all areas of the gymnasium during fitness instruction. That is, teachers need to be aware of the benefits of using distant interactions as part of their active supervision efforts to increase/sustain students' MVPA during fitness instruction as part of the process aimed at shaping physical activity behavior in youth.

Distant Interactions and Their Effects on Children's Physical Activity Levels During Fitness Instruction

by

Debra Lynn Patterson

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I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

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Debra Lynn Patterson, Author

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Introduction

Today, more than ever, it has become common to hear how unfit and sedentary our society has become (U.S. Department of Health and Human Services, 1996; CDCP, 1997; Summerfield, 1998). While children represent the most fit and active section of society, there are concerns children may not be active enough for current or future health benefits (Biddle & Goudas, 1996; USDHHS, 1996). Recently, it has been observed that physical activity patterns of health-related behavior are established in childhood and may continue into adulthood (Sallis & McKenzie, 1991; Sallis, McKenzie, & Alcaraz, 1993; Malina, 1996; Corbin & Pangrazi, 1998; Shephard & Trudeau, 2000). Since 97% of students attend or have attended elementary school, elementary physical education programs are the primary place to focus for developing students' physical activity habits (Sallis & McKenzie, 1991; McKenzie, Feldman, Woods, Romero, Dahlstrom, Stone, Strikmiller, Williston, & Harsha, 1995; Summerfield, 1998). However, an alarming trend is emerging in elementary education to decrease the amount of time allocated to physical education (U.S. Public Health Service, 1995; USDHHS, 1996). In fact, most elementary students only receive physical education two or three days per week (USDHHS, 1996). In spite of all of the messages regarding the need to educate children on the benefits associated with physical activity, the reduction of the frequency of physical education classes poses a serious threat to shaping the physical education patterns of youth.

A recent action statement by Corbin and Pangrazi (1998) in the Physical Activity for Children: A Statement of Guidelines, as well as the President's Council on Physical Fitness and Sports Physical Activity and Fitness Research Digest (1996) recommends that teachers focus more on the process of physical activity versus the product or outcome (e.g., fitness test results). Additionally, Sallis and McKenzie (1991) stated that physical education programs should be changed to focus on lifetime physical activities that carry over into adulthood. As children experience and develop habitual physical activity patterns, it is more likely that these behavior patterns will carry over into adulthood (Sallis & McKenzie, 1991; Malina, 1996: Corbin & Pangrazi, 1998). This change has implications at both the curricular and instructional levels (van der Mars, Vogler, Darst, & Cusimano, 1998). One instructional strategy that has been shown to correlate with higher physical activity levels in students at elementary school levels is the promotion of physical activity by teachers through verbal prompts, encouragement, and feedback (McKenzie, Sallis, & Nader, 1991; McKenzie et al., 1993; Biddle & Goudas, 1996; Corbin & Pangrazi, 1998). By providing students' effective instruction and positive experiences in health related fitness activities, they are more apt to continue to be physically active later on in life (Sallis, McKenzie, & Alcaraz, 1993). Promoting physical activity is one way in which teachers attempt to hold students accountable for being active in class.

Over the last few decades research has focused on how tasks get accomplished in both the classroom and physical education settings. For example, Doyle (1979) thoroughly investigated this notion in the classroom setting. He presented two task structures, order and learning, commonly used in the classroom. Tousignant and

Siedentop (1983) applied Doyle's work into an ecology of teaching model directed towards physical education which contained three task structures: managerial, student-social, and instructional. The managerial task structure involves the organization of non-subject matter functions such as protocols and grouping of students, while the student-social structure deals with the social interaction students seek. The instructional task structure involves the subject matter functions such as providing instructions, feedback, and prompting.

Teacher monitoring, also called active supervision, is comprised of all the strategies teachers use to keep abreast of students' conduct, safety, and progress on learning tasks. There are many different components, some of which include the use of feedback, prompts, encouragement, and correction (Siedentop & Tannehill, 2000). When teachers actively supervise by providing feedback, students on task behavior increases (Jones, 1992; Rikard, 1992; van der Mars, Vogler, Darst, & Cusimano, 1994) and teachers find their teaching more pleasant (Siedentop et al., 2000). Within the task structures model, teachers hold students accountable through active supervision, challenges, and records of performance (Siedentop et al., 2000). Techniques used to hold students accountable in physical education are much different than those used in the classroom. Results from classroom research indicate that classroom teachers use a more formal method of a performance-grade exchange, usually have smaller areas to supervise, and the negotiations of tasks is between the student and the teacher. In contrast, physical education teachers usually have no formal exchange of grades, supervision is difficult due to the large areas, and students negotiate the task by modifying tasks.

To bring to light additional information regarding teacher effectiveness, Kounin (1970) found that when teachers exhibit situational awareness, a skill he termed "withitness", students increased their on-task behavior in the classroom. Withitness is defined as the teacher being able to spot inappropriate behavior and respond to it promptly. Effective withitness requires the use of teacher monitoring the pace, and rhythm of what is going on in the classroom (Doyle, 1986). The concept of withitness results in the hypothesis that upon realizing what is acceptable to the teacher who displays withitness, students are more apt to stay engaged in the assigned work.

An additional aspect of monitoring involves teacher proximity. Most of the research on teacher proximity has been performed in the classroom (Gunter, Shores, Jack, Rasmussen, & Flowers, 1995; Van Houten, Nau, MacKenzie, Sameoto, & Colavecchia, 1982). Students exhibit more task engagement behavior when the teacher is in close proximity. One study in particular (Gunter et al.) U.S. Public Health Service found that when teachers moved throughout the room, students had higher levels of academic engagement independently as compared with the teacher maintaining a fixed position. Hastie (1993; 1994) investigated teacher monitoring and found that students had higher levels of involvement in physical education when the teacher was in close proximity. He further found that the accountability factor of monitoring had a direct effect on students valuing the teacher during physical education classes. It appears that the role of teacher proximity may increase the likelihood of students maintaining task engagement. Siedentop (1991) placed these monitoring concepts in the context of physical education. It was suggested that

teachers also demonstrate or participate intermittently in the activity as an additional feature of active supervision. By holding the students accountable through the use of active supervision, children's moderate to vigorous physical activity (MVPA) levels should be enhanced (Sariscsany, Darst, & van der Mars, 1994; van der Mars et al., 1998). These findings have been documented in the physical education setting (van der Mars et al., 1994; 1998) and are consistent with the research in the classroom setting (Kounin, 1970).

Rikard (1992) demonstrated that effective teaching through the use of feedback increased and higher levels of on-task behavior. While the use of feedback and other forms of interaction as components of active supervision has been studied extensively, there is limited information on the specific role of distant interaction in active supervision (Sariscsany et al., 1995).

Patterson & van der Mars (2000) investigated the effects of distant interaction on elementary students during fitness instruction. This study used a reversal design with two different treatment conditions: distant and close interaction. Distant interaction was defined as the teacher providing prompts, encouragement, and feedback to the students across the gymnasium. During the close interaction condition, the teacher provided interaction only to the students who were in close proximity to him. Using two fourth grade classes, the teacher conducted station format fitness instruction while implementing either the distant or the close interaction condition. This study only investigated the students most distant from the teacher. The results indicated that the students farthest from the teacher increased their MVPA levels

during the distant interaction conditions as compared with the close interaction conditions due to the teacher providing verbal interactions across the gymnasium.

With the limited amount of research on the effects of distant interaction and teacher proximity, a systematic replication of the study by Patterson & van der Mars (2000) across grade levels and with physical education teachers is justified. Another important aspect to investigate is the MVPA level of the students closest to the teacher during the distant interaction conditions while also considering the MVPA levels of the students who are farthest from the teacher during the close interaction conditions. This would allow for a careful analysis of the role of proximity. Ultimately, the goal within physical education class is for students to continue their physical activity engagement even though the teacher is not in close proximity. Thus, the function of distant interaction is to convey to students the teacher's true expectations in gradually shaping such independent behavior.

The purpose of this study was to investigate the effects of distant interactions by elementary physical education teachers' on the physical activity levels of elementary school students during fitness instruction, across grade levels, and using a variety of fitness activities.

Methods

Participants & Setting

Teachers

Two certified elementary physical education teachers volunteered to participate in this study. Ann, a female physical education teacher had five years teaching experience at her present school (Aloha Elementary) and a total of thirteen years teaching physical education at the elementary level. Ted, a male physical education teacher had eleven years of teaching experience at his present school and at the elementary level (Seaside Elementary). Both teachers signed an informed consent prior to this study (see Appendix A).

Students

A total of five classes (grades 3-5) from two rural elementary schools in the Northwest, U.S. participated in this study. All classes have been given fictitious names to remain anonymous. Students were observed while engaged in their regular physical education class. The sample of students at Aloha elementary school included 54% Anglo-American, 44% Hispanic-American, 1% African-American, and 1% Pacific Islander. Twenty-nine percent of the students had 29% limited English proficiency. The sample of students from Seaside elementary school included 83% Anglo-American, 4% Asian-American, 4% African-American, 9% Hispanic-American. Informed consent (parents) (see Appendix A) and assent (students) (see

Appendix A) was obtained using procedures approved by the Oregon State University Institutional Review Board (IRB) (see Appendix C).

Setting

Both schools had approximately 300 students. Class sizes ranged from 24-28 students. The percentage of students eligible for free or reduced lunch was 75% and 21% for Aloha and Seaside, respectively. Both teachers conducted their lessons in an indoor gymnasium that was approximately 5000 square feet. The schools had enough physical education equipment so students could have their own if necessary. This minimized excessive wait time during the lesson.

Program Content

A multi-activity based curriculum implemented by both teachers focused on introducing students to a variety of physical activities through a fundamental approach (Pangrazi, 1998). Each 30-minute lesson included a 7-9 minute health-related fitness portion. This study observed the behaviors of the teachers and the students during the fitness portion of the lesson. Five components of health-related physical fitness included cardiovascular fitness, muscular strength, muscular endurance, flexibility, and body composition.

Target Behavior

The dependent variable was the percentage of most distant and proximal students engaged in moderate to vigorous physical activity (MVPA) behavior. Recent

findings showing a relationship between the onset of chronic diseases and sedentary lifestyles supports the importance of examining MVPA.

Intervention

The independent variable was the direction of the teachers' verbal promotion of physical activity to students per condition. Following a baseline phase (A), there were two conditions implemented and repeated across multiple sessions. Condition C-IA (close interaction) consisted of the teacher's active supervision targeting only to those students in her/his immediate area (except for possible safety issues). The Condition D-IA (distant interaction) was also considered active supervision but had the teachers target their interactions to those students at the fitness station or areas farthest removed from where they were located. For both conditions, the teacher continued to move around the perimeter of the class.

The teacher was prompted prior to class by the researcher and during the activity by the use of a prerecorded audio cue microcassette tape on the condition to implement. For both conditions C-IA and D-IA, the teacher was asked to provide interaction at a rate of 5 per minute, which was reflective of both teachers typical rate of interaction and resembles those reported in previous research (van der Mars et al., 1994; 1998b).

Fidelity of Treatment

Fidelity of treatment is the verification that the intended experimental conditions were actually implemented by the teacher. To ensure fidelity of treatment,

data were collected to verify that the teacher was providing interaction to students in the proximity rendered by the condition in effect.

The teachers reviewed randomly selected videotapes from each condition along with completing the Teacher Verification Form (Appendix A) during the same week the data were collected to ensure that the students they provided interaction to were, in fact, located as per the condition they were teaching under. Thus, the teacher verified the condition being implemented by identifying where her/his interaction was directed. The Teacher Verification Form required the teacher to code a total of 4 minutes (24 intervals) for each class using partial interval recording.

Confounding Variables

With active supervision having so many components such as visual scanning, movement, periodic modeling, and student interactions it was necessary to make sure that the only component altered was the direction of the verbal promotion of physical activity. Therefore, an attempt was made to verify that other active supervision components remained relatively consistent. The teachers were asked to maintain a reasonably consistent interaction rate and movement pattern.

The rate of teacher interaction was estimated using partial interval recording with 10-second intervals (van der Mars et al., 1989a) to ensure that the overall rate of interaction was similar across conditions.

To monitor the amount of teacher movement during the fitness activities, each teacher wore a digital step pedometer. The number of steps was recorded at the conclusion of each fitness activity. Monitoring of the number of steps per session

provided additional information on the teacher's behavior across conditions and the possible influence on students' physical activity levels.

Procedures

The behaviors of the teacher and the students were observed during the fitness portion of the lesson. The teachers' were instructed on the use of active supervision strategies. The teacher and the researcher discussed strategies that emphasized specific characteristics of interaction and prompting to increase students' on-task behavior. Strategies included teacher movement around the perimeter of the gym and the use of specific and general interactions. The teachers wore a cordless microphone dubbed to a videocamera used to monitor their verbal behavior during all sessions. Teachers were instructed to provide interaction at a rate of 5 per minute.

A variety of different fitness activities, all with a similar format, were implemented. The teachers' were provided all of the necessary materials for three different fitness activities. For Circuit Training, the teacher was provided with 28 different health-related fitness activity station task cards (six stations per activity). Other fitness activities included a Squad Leader Activity that utilized a fitness card with ideas for the students to use when they led the exercise. Continuity Exercises included the student's alternating individual jump roping with various muscular strength and flexibility exercises. Although the fitness activities were different they were all consistent in the manner in which contained 30-40 seconds of activity and 5-seconds of transition between each exercise bout. Each teacher received five different 30-second and 40-second cued music tapes with a 5-second transition pause

for a total of 20 minutes. The designated health-related fitness activities were taught by the physical education teachers' throughout the study.

Each lesson was videotaped to assist in coding MVPA data for students closest to the teacher, verifying the experimental condition implemented by the teacher, and the teachers use of promoting physical activity. The videocamera was located in the corner of the gymnasium so the teacher and the students could be kept in view at all times. A 52x wide-angle video lens was utilized to capture the full view of the gymnasium. A character generator provided a superimposed running clock on the videotape to use in the verification of data collection. The gymnasium floor was sectioned into nine sectors to determine teacher proximity to the target group of students (van der Mars, 1989c). Red vinyl tape marked the gymnasium floor along with orange boundary cones to aid in visual discrimination between sectors. Blue vinyl tape was placed at the intersections of the sectors and used on the walls around the perimeter of the gymnasium to assist in the visual accuracy of the stations.

Research Design

A reversal design (Cooper, Heron, & Heward, 1987) was implemented to analyze the functional (i.e., causal) relationship between the teacher's use of distant interaction and the target students' MVPA during the fitness portion of each class. The reversal design is a commonly used design in applied behavior analysis. A reversal design entails introducing, withdrawing, and reintroducing the independent variable on the target behavior. This design allows for replication and verification of a causal

relationship between the independent variable on the target behavior. With this design, each class serves as its own experimental control.

The decision on when to change conditions was not set a priori. Conditions were observed over multiple occasions. Emerging data paths were used to guide the researcher when to change conditions.

Data Collection

Data were collected from the start of the music to the end of the fitness instruction. Data were collected "live" by a trained observer using momentary time-sampling for 10-seconds to estimate the distant students' physical activity levels (van der Mars, 1989a). The MVPA for students' closest to the teacher was coded from the videotape. A modified version of the System for Observing Fitness Instruction Time (SOFIT) (McKenzie et al., 1991) Observation Coding Form (see Appendix A) was used to collect students' MVPA data. The original SOFIT instrument quantifies levels of physical activity of students from an intensity perspective and measures the context of teacher behavior. The SOFIT physical activity categories have been validated for use with elementary students by using the correlation with energy expenditure estimates, heart rates, and accelerometers (McKenzie, et al., 1991; Rowe, Schuldheisz & van der Mars, 1997). The SOFIT physical activity categories used for this study were validated by Rowe, Schuldheisz & van der Mars, & Fox (1997). The combining of Codes 1-3 (i.e., lying down, sitting, and standing) were coded as "no MVPA" and Codes 4-5 (i.e., walking and very active) coded "yes MVPA", based on a study by Rowe et al. (1997).

As the teacher moved around the perimeter of the class he/she would provide interaction for the specific condition rendered. Condition C-IA consisted of active supervision with the teacher interacting only with those students in her/his immediate area (except for safety issues). During condition D-IA the teacher interacted with those students at the fitness station who were the farthest proximity from where he/she was located.

Teachers' interactions were coded using the original SOFIT teacher behavior categories and partial interval recording with 10-second intervals (van der Mars, 1989a) to ensure that the overall percentage of interaction was similar across conditions. Six specific teacher behavior categories were observed: promoted fitness, demonstrated fitness, instructed generally, managed students or the environment, observed the class, and off-task behavior. The following definitions are from McKenzie et al., 1991. The "promoted fitness" category was defined as promoting fitness by prompting or encouraging fitness activity. The "demonstrated fitness" category was defined as modeling fitness engagement. The "instructed generally" category included lectures, instruction, prompts, or feedback to students related to all physical education content except fitness engagement. The "managed" category was defined as managing students or the environment by engaging in non-subject matter tasks. The "observed" category was defined as monitoring the entire class, group, or an individual and was only coded if it occurred throughout the entire interval. The "off-task" category was defined as the teacher attending to events not related to her/his responsibilities to the class at hand. The teacher interaction behavior categories

were coded using a hierarchical order. Only one category was coded for each 10-second interval.

Observer Training and Reliability

The observer was trained in the use of SOFIT instrument physical activity and teacher behavior categories with prerecorded "gold standard" videotapes of elementary physical education lessons until a 90% or better interobserver reliability on videotapes expert ratings was established. The observer used a modified SOFIT observation coding form (see Appendix A) and a prerecorded 10-second cue tape. During the fitness portion of each lesson, the observer rated and coded the student's physical activity level at the fitness station/sector farthest from and closest to the teacher. The observer coded "live" the group of students who were farthest from the teacher and coded the students closest to the teacher from the recorded videotape. The observer also coded the total number of students at the station observed.

To ensure observer reliability and guard against observer drift, the percentage of agreement between two trained observers was established by calculating interobserver agreement (IOA) on students' MVPA levels across randomly selected sessions for each experimental phase. This procedure has been reported as the most common method for reliability (van der Mars, 1989b). The percentage of observer agreement among observers was calculated by dividing the number of observer agreements by the total number of observer agreements and disagreements and multiplying by 100 (Cooper et al., 1987). At least one interobserver agreement was performed for each class during each condition. To code the data both observers

listened to the same prerecorded audiocassette tape cued at 10-second intervals. To ensure observer independence was achieved during the procedure, both observers were located far enough apart that neither could detect what the other was recording (van der Mars, 1989b).

Data Analysis

The students' MVPA data were calculated into percentages and plotted graphically. The data were analyzed visually, using data overlap, change in level, trends within and across phases, and variability within and across phases as criteria to determine the functional relationship between the teacher's supervision techniques and the students' physical activity levels (Parsonson & Baer, 1992). Both session means and phase means were calculated for all conditions.

Results

Interobserver Agreement

At least one interobserver agreement (IOA) check was conducted for each class during each condition for student MVPA and teacher behavior data. Classes were randomly selected. IOA data included separate coding for the students closest to the teacher and the students farthest from the teacher. Further, the IOA's were performed on all three types of fitness activities. The range for the overall IOA's percentages for MVPA (including close and distant conditions) was 87.5-100%. (see Table 1). The IOA percentages for the teacher behavior categories were 100% for all classes. These results suggest the observer was reliable.

Table 1 Interobserver Agreement Percentages & Total Mean Values for MVPA

Class Group	**Conditions (close students / distant students)**							**Total Means**
								Close
								Distant
Golden	A	C-IA	D-IA	C-IA	A	C-IA	D-IA	
	100	95.2	96	93.9	94.2	94.7	97.2	95.8
	89.2	95.2	92.3	90.1	91.4	91.8	94.4	92.0
Victor	A	D-IA	C-IA	A	D-IA	C-IA	D-IA	
	92.5	91.8	93.5	95.1	92.6	91.8	94.2	93
	96.2	91.8	95.5	92.6	90.1	90	94.2	92.9
Wally	A	D-IA	C-IA	D-IA	A	C-IA	D-IA	
	96.4	94.5	96.1	96.5	96.4	94.4	97.2	95.9
	96.4	94.5	96.1	87.5	92.5	94.4	94.4	93.6
Frank	A	C-IA	C-IA	D-IA	A	C-IA	D-IA	
	96.6	92.3	94.2	90.9	94.5	91.8	94.4	93.5
	100	94.8	91.4	90.9	91.8	94.5	88.8	93.1
Smith	A	D-IA	C-IA	A	D-IA	C-IA		
	95.1	91.8	93.5	95.1	92.6	91.8		93.3
	100	91.8	95.5	92.6	90.1	90		93.3

Conditions: A = Baseline; C-IA= Close Interaction; D-IA = Distant Interaction

Fidelity of Treatment

Both teachers viewed a random sample of classes to verify that the condition in effect was implemented faithfully. Seven sessions (26-30%) for each class across all conditions were verified. The percentage of intervals that the teachers interacted with students under the correct condition was calculated (see Table 2). The data indicated that the teachers implemented the correct conditions.

Table 2 Teacher Verification of Conditions Implemented

Ann's Classes		Ted's Classes	
Golden's	100%	Smith's	98.9% (92.8-100%)
Victor's	100%		
Wally's	100%		
Frank"s	97.2% (range 85.7-100%)		

Managing Potential Confounding Variables

Active supervision patterns of teachers have multiple behavioral components. Some include movement, positioning, periodic participation, visual scanning, and interactions with students. In an effort to strengthen the argument that the distant interactions were responsible for any intervention effect, data were collected on other possible confounding variables. They included SOFIT's teacher behavior categories as well as the teachers' rate of movement. The intent was for both the teacher behaviors to remain relatively unchanged across conditions.

The promoting fitness engagement resulted in the highest means of all teacher interaction behavior categories using the SOFIT instrument. The other five teacher behavior categories produced minimal to zero responses for all five classes. The results indicated that the teacher's promoted fitness engagement consistently across all conditions for all classes (see Figures 1 & 2). After the initial baseline condition and shortly after the initial interaction condition started, the teacher's movement during fitness was recorded using a digital step pedometer. Analyzing the number of steps per session provided additional information on the role of the teacher's movement behavior for all groups throughout the study (see Figures 3 & 4) and the possible effects on students activity levels. For Smith's class, the teacher movement did not indicate any substantial change in student MVPA levels. The data for Ann's groups indicated possible influence in MVPA levels due to major fluctuations in teacher movement. During the sixth session and under condition D-IA, the teacher's number of steps ranged from 670-740 for Victor's and Wally's classes. The distant students in Wally's increased their MVPA while the close students slightly decreased their MVPA. The close students in Victor's class increased their MVPA while the distant students had a slight decrease in MVPA. During the tenth session and condition C-IA, Ann's steps were under 100 for all classes. There was a slight decrease in student MVPA for the distant students in all classes. This may suggest that a lower level of teacher movement along with only providing interaction to those students closest to the teacher could play a role in the activity levels of the students most distant.

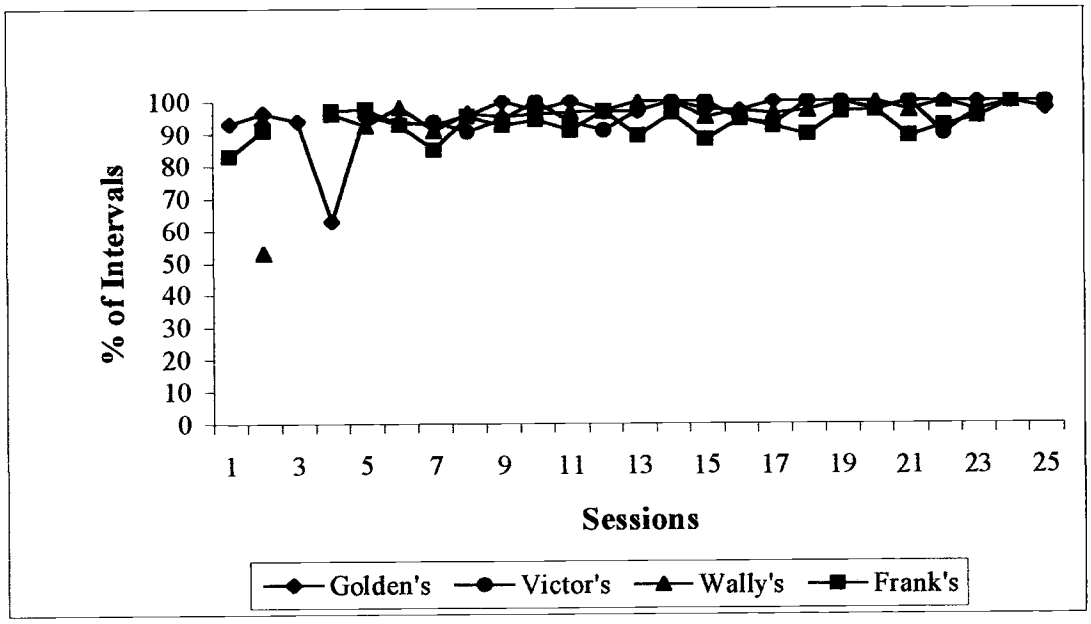

Figure 1 Teacher interaction behavior "promoting" across conditions for Ann.

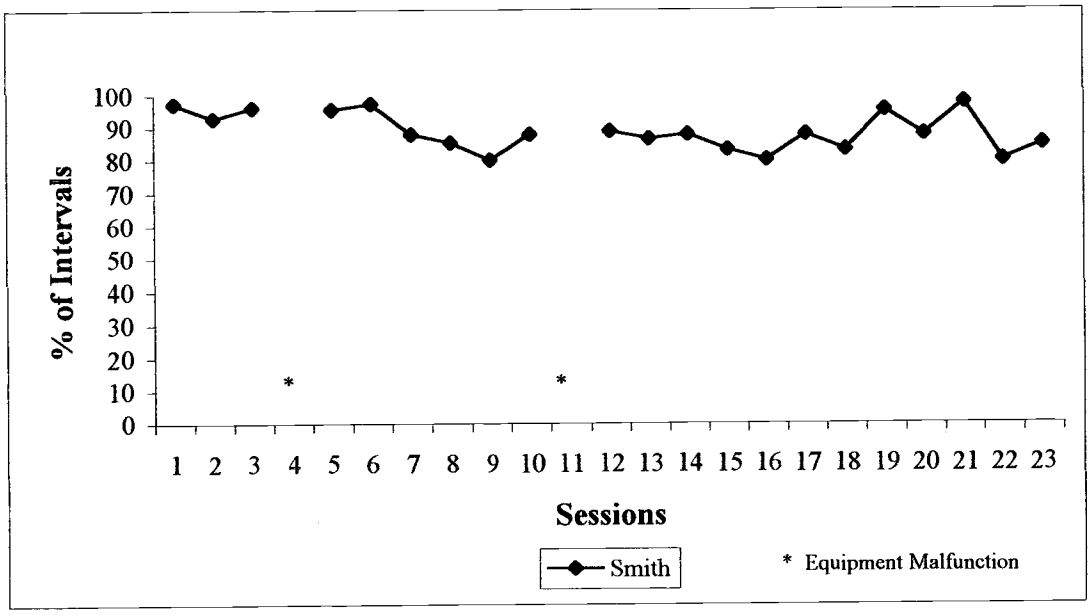

Figure 2 Teacher interaction behavior "promoting" across conditions for Ted.

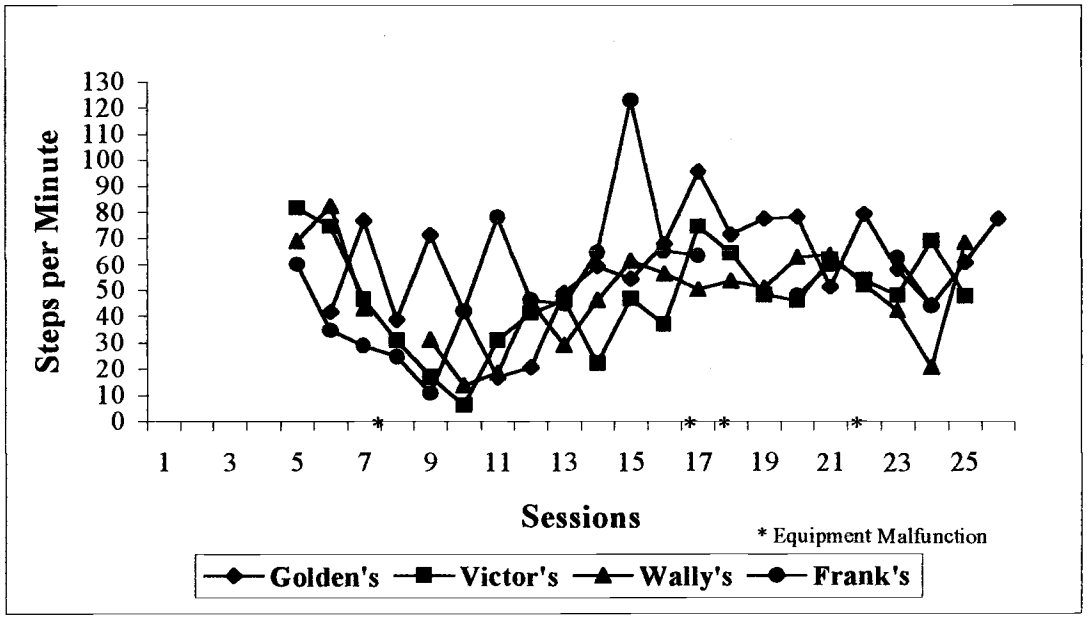

Figure 3 Verification of teacher movement across conditions for Ann.

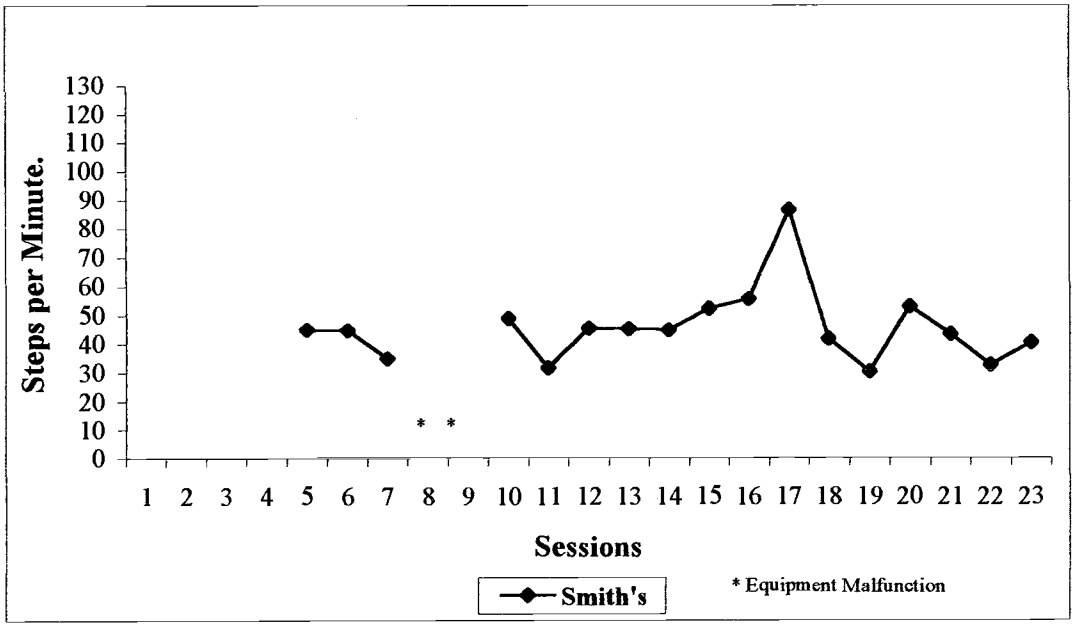

Figure 4 Verification of teacher movement across conditions for Ted.

Student Engagement in MVPA

Previous research on the effects of proximity indicated that students closest to the teacher exhibited on-task behavior. This study focused on the physical activity levels of both the students in close proximity to the teacher as well as students farthest from the teacher during the fitness component of the lesson. This study investigated the effects of the teacher directing promotion of physical activity (interaction) to both groups of students using two conditions (C-IA and D-IA) across multiple sessions. The data for both groups of students should provide an indication of the strength of the intervention by looking at the replication within each class and across classes.

Classes were observed over 19-26 sessions using a reversal design. Initial conditions were randomly selected for each group. Two groups concluded this investigation under the original condition. For all classes the second baseline condition was observed following a two week school break.

Visual inspection of the baseline data from all classes indicated that MVPA levels were higher among the students closest to the teacher with means ranging from 86.4 – 93.5%. MVPA levels were consistently lower for the students located farthest from the teacher (range 65.2 - 84.3%). Overall, baseline MVPA levels for all classes were very high. This was due to the effectiveness of both teachers. It was observed that both teachers employed active supervision strategies that included distant interactions during the baseline conditions.

Golden's $4^{th}/5^{th}$ grade class started with condition C-IA close interaction (see Figure 5). The data for the distant students indicate an increase in MVPA during the condition D-IA across all phases. There were sizable level changes between conditions

for the distant students. This suggests that the distant students were responding more favorably when the teacher directed interactions across the gymnasium versus just to the students in close proximity. The replication of the increased MVPA behavior for the distant students during the condition D-IA indicates a causal relationship. The students closest to the teacher maintained fairly stable MVPA levels across all conditions. There were no sizable level changes within or between phases. There was a minimal decrease in MVPA during the condition D-IA. This suggests that although the teacher was not providing interaction to the students closest to them, the close students were able to maintain a stable pattern of MVPA.

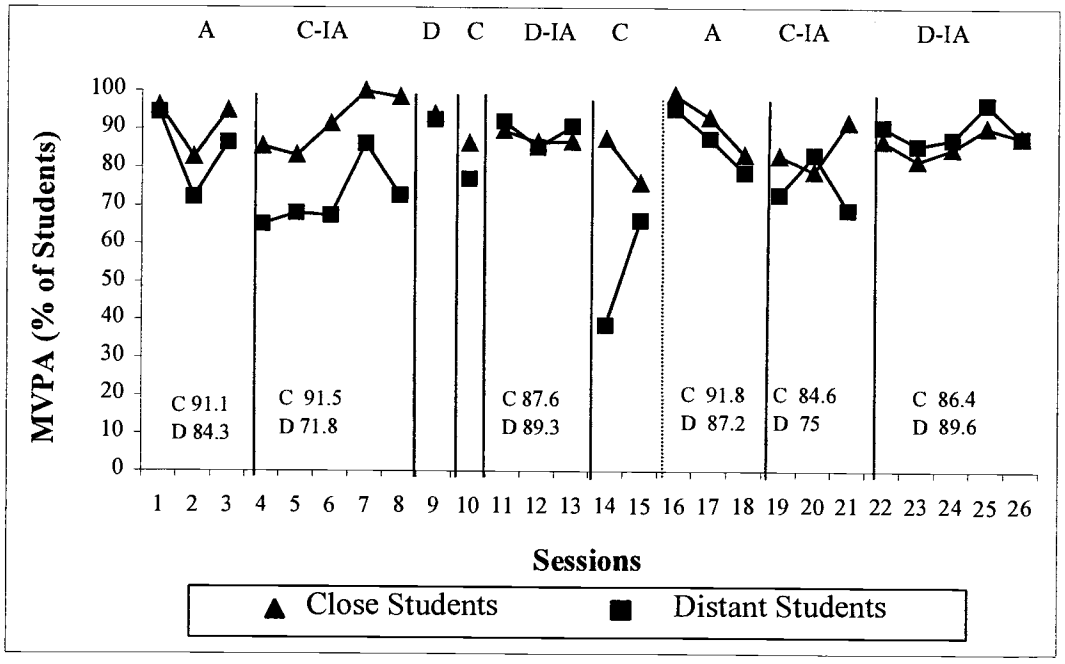

Figure 5 Mean percentage totals of MVPA during fitness for Golden's class.

For Victor's 3rd/4th grade class, a consistent pattern emerged across conditions (see Figure 6). Across all C-IA conditions, the students closest to the teacher had higher MVPA levels than the distant students as indicated by the phase means. In contrast, across all conditions D-IA, the students farthest from the teacher had higher MVPA levels than the students located closest to the teacher. During condition D-IA, the distant students maintained stable patterns of MVPA but there where sizable level changes across conditions that resulted in lower MVPA levels. The data indicated that students closest to the teacher had some variability within several phases but the level changes were fairly stable across conditions. These results indicated that the students responded with higher MVPA levels when the teacher provided interaction specifically to where they were located.

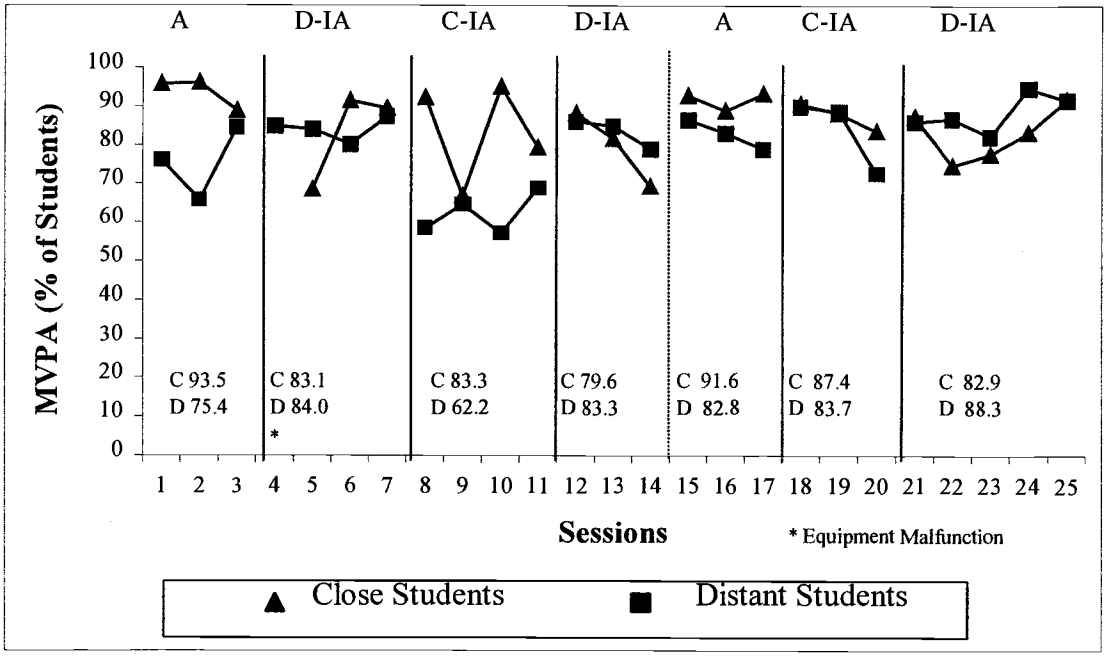

Figure 6 Mean percentage totals of MVPA during fitness for Victor's class.

Wally's fourth grade class had a high percentage of MVPA for both distant and close students across all conditions (see Figure 7). The students closest to the teacher achieved higher levels of MVPA across the first five conditions compared with the distant students. There was a consistency with the level changes across conditions for the distant students. The MVPA levels increased at the onset of condition D-IA and decreased at the onset of condition C-IA. The distant students consistently increased their MVPA levels during the conditions D-IA as compared with slight variability with condition C-IA. The data for the close students indicated a stable pattern of MVPA within and across conditions.

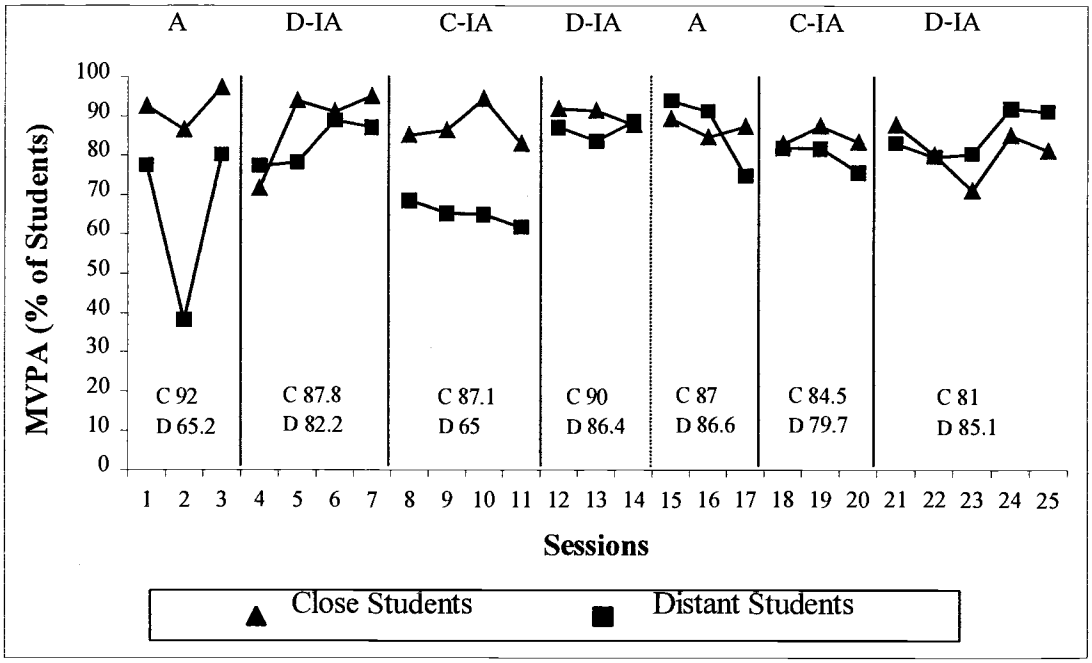

Figure 7 Mean percentage totals of MVPA during fitness for Wally's class.

The data from Frank's fifth grade class (see Figure 8) replicates the results from the previous classes. The distant students increased their MVPA during the condition D-IA while decreasing MVPA during condition C-IA. The data for the distant students demonstrated sizeable level changes from one condition to the next. There was a consistent pattern of increased MVPA during the onset of condition D-IA and a decrease in MVPA at the onset of condition C-IA. The distant students maintained a stable trend of lower MVPA within all the phases for condition C-IA. This up and down pattern for the distant students between conditions is replicated across all phases. The data for the close students indicate a stable pattern of high MVPA levels within and across all conditions.

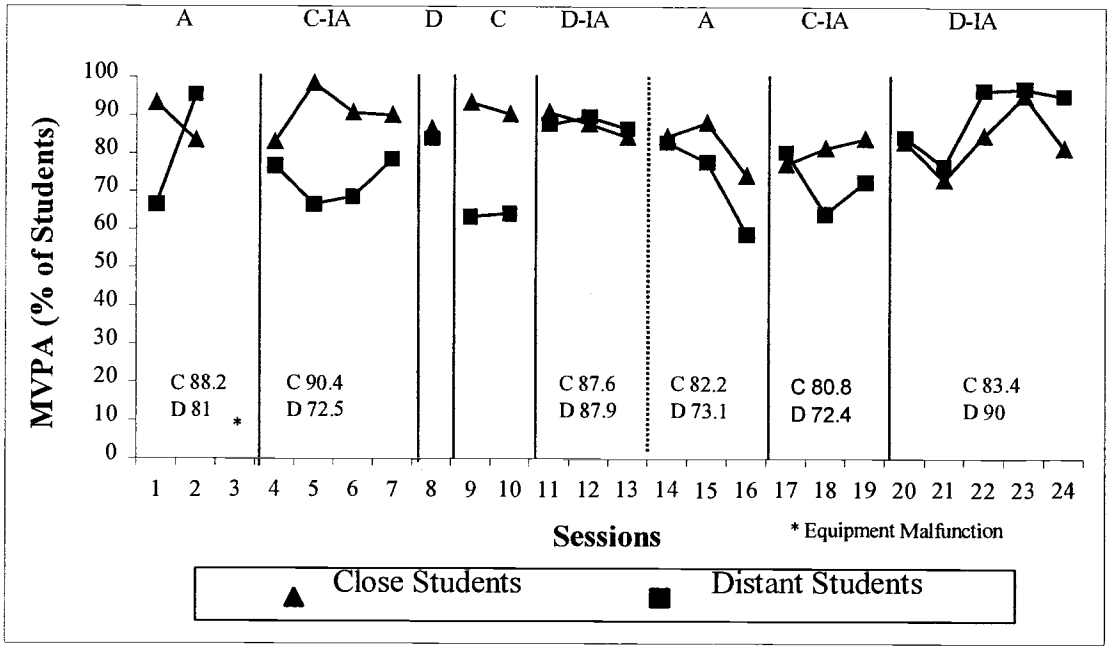

Figure 8 Mean percentage totals of MVPA during fitness for Frank's class.

Analysis of the data for Smith's third grade class indicated slight variability among both the close and distant students groups across all conditions (see Figure 9). The distant students demonstrated higher levels of MVPA during both conditions D-IA as compared with a condition C-IA. There was overlapping data within phases and across conditions for the distant students. During the initial D-IA condition, both groups of students experienced a moderate increase in physical activity for 3 sessions then a sharp decrease in MVPA due to learning a new continuity fitness activity. The final onset of condition C-IA produced sizeable level changes for both groups. There was a decrease in MVPA for the distant students while the close students increased their MVPA. The distant students may require more teacher interactions during different fitness activities. Except for the final D-IA, the distant students demonstrated lower MVPA levels across all conditions compared with the close students.

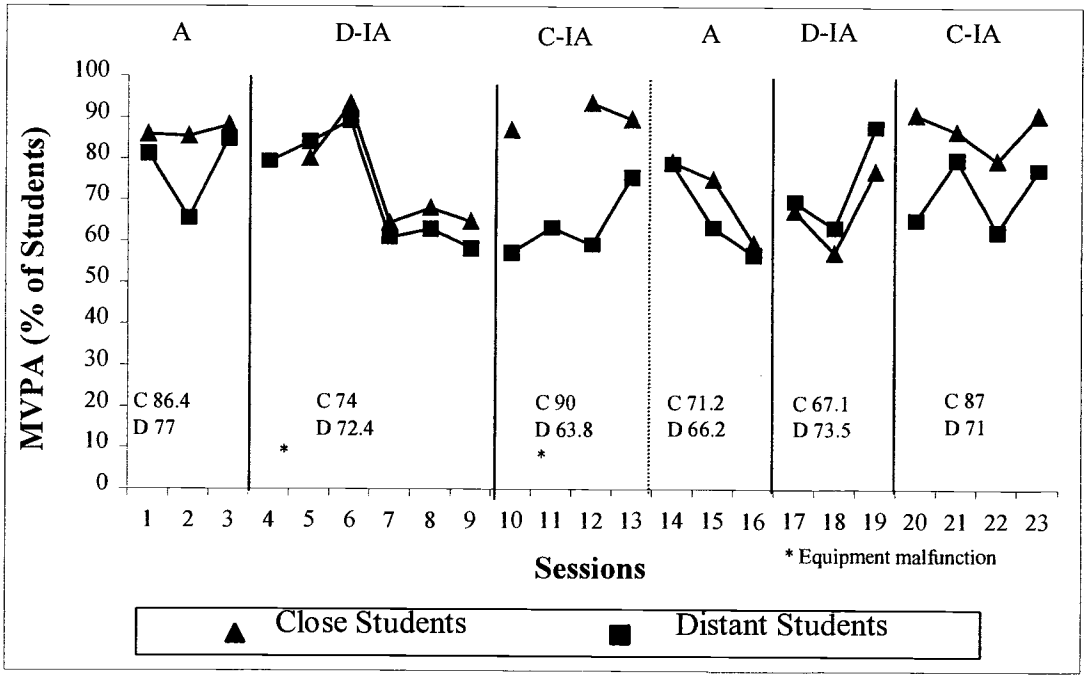

Figure 9 Mean percentage totals of MVPA during fitness for Smith's class.

Discussion

The purpose of this study was to investigate the effects of distant interaction by the elementary physical education teacher on physical activity levels of elementary school students during fitness instruction. The results indicated a consistent pattern of increased MVPA levels for the distant students during the condition D-IA as compared with a consistent decrease in MVPA levels during condition C-IA. This pattern was replicated for all classes. These results provide evidence that teachers should focus on actively supervising and interacting with all students, especially those located farthest from them. The findings from this study are consistent with research supporting active supervision can increase student's task engagement behavior (Jones, 1992; Hastie, 1993; 1994; Gunter et al., 1995; van der Mars, et al., 1998; Patterson & van der Mars, 2000).

With regards to proximity, the findings from this study indicated that the students closest to the teacher maintained high levels of MVPA across all conditions. That is, even though the teacher was not interacting with the students closest to them the students still maintained a high level of task engagement. This finding is consistent with previous research on the effects of proximity (Gunter et al., 1995, Hastie, 1993). When the teacher was providing interaction across the gymnasium, the distant students increased their MVPA levels while the teacher was not in close proximity to them. Moreover, it was demonstrated through this study that students continuously maintained their physical activity engagement without the teacher being in close proximity and with the use of verbal interactions.

The active supervision strategy of providing verbal interactions of prompts, encouragement, and feedback provided by the teacher has been shown to be effective at the elementary school levels (McKenzie et al., 1993; Biddle & Goudas, 1996; Corbin & Pangrazi, 1998; Patterson & van der Mars, 2000). Together the effects of teacher proximity and distant interaction reflect the definition of withitness. That is, the teacher was holding students accountable by employing active supervision, the students realized this and maintained or increased their task engagement.

Thus, the use of distant interactions has been demonstrated to play an important role in starting the learner toward becoming active, independently. The ultimate goal in elementary physical education should be to turn students on to physical activity with the hope that it will continue throughout their life. By providing active supervision and teaching process oriented fitness instruction students may be more apt to continue to be physically active throughout their life (Sallis, McKenzie, & Alcaraz, 1993). This is especially important in light of previous research that states physical activity patterns established in childhood may carry over into adulthood (Malina, 1996; Shephard & Trudeau, 2000).

Applied behavior analysis utilizes systematic replication of the intervention to increase the strength of generalization. Although the results from this study cannot be generalized across other elementary physical education programs, the information gathered will contribute to the growing knowledge base on instructional strategies. Through further replication of the effects of distant interaction, both the researcher and the practitioner can benefit by applying new practices into the classroom.

A limitation involved with this study was that the use of the mean values of small groups of students might have masked the effects of individual differences in responses to the conditions and may have added to the within phase variability. An additional limitation was the context of the different fitness activities. The continuity exercise activity was new to one class of students and resulted in lower MVPA levels for the first three sessions the activity was used.

The strength of this study was that it was performed using classes from three straight grade levels (3^{rd}, 4^{th}, & 5^{th}), two mixed grade levels (3/4 & 4/5), and mixed ethnicity across grade levels. The results of distant interaction had positive effects on increased MVPA across 4 out of 5 classes and across all conditions. This study also demonstrated the importance of experienced teachers needing to maintain vigilant active supervision behavior when attempting to shape physical activity behaviors through a process orientation.

Conclusion and Implications

This study found that when the teacher provided verbal promotion across the gymnasium those students located farthest from the teacher increased their MVPA levels. There was a consistent decrease in the MVPA levels of the distant students when the teacher directed interactions to the students in close proximity. However, as soon as the teacher did interact with the distant students the levels of MVPA increased. This pattern was replicated throughout all of the classes. Overall, there was no negative effect on the close students during distant interaction. In fact, for 4 out of 5 classes the students closest to the teacher maintained their high levels of MVPA when the teacher was only providing distant interaction. The results from this study add to the growing information of specific instructional strategies that teachers can use to help students increase MVPA levels.

With the abundance of information (USDHHS, 1996; CDC, 1997; Corbin & Pangrazi, 1998) aimed at increasing students' physical activity levels, the findings of this study may prove advantageous not only for elementary physical education teachers but for professionals in charge of teacher preparation programs. The information gained from this study demonstrates the benefits of employing active supervision behavior for both prospective and experienced teachers.

Future research should focus on the replication of the intervention across different grade levels, different sections of the lesson, and using a variety of teachers with varying years of teaching experience. To further strengthen the generalization of

distant interaction, it would be useful to investigate students with varying abilities and ages. It would also be valuable to examine the students' perceptions of their physical activity exertion during both the close and the distant conditions.

Bibliography

Biddle, S., & Goudas, M. (1996). Analysis of children's physical activity and its association with adult encouragement and social cognitive variables. Journal of School Health, 66, 75-78.

Centers for Disease Control and Prevention. (1997). Guidelines for school and community programs to promote lifelong physical activity among young people. Morbitity and Mortality Weekly Report, 46, 1-46.

Cooper, J., Heron, T., & Heward, W. (1987). Applied behavior analysis. Columbus, OH: Merrill Publishing.

Corbin, C. B., & Pangrazi, R. P. (1998). Physical activity for children: A statement of guidelines. National Association for Sport and Physical Education. Reston VA: AAHPERD.

Doyle, W. (1979). Classroom tasks and students abilities. In P. Peterson and H. J. Wolberg (Eds.). Research on teaching: Concepts, findings, and applications (pp. 183-209). Berkeley, CA: McCutchan.

Doyle, W. (1985). Recent research on classroom management: Implications for teacher preparation. Journal of Teacher Education, 36, 31-35.

Doyle, W. (1986). Classroom organizations and management. In M.C.Wittrock (Ed.), Handbook of Research on Teaching (pp. 392-431). New York: Macmillan.

Gunter, P. L., Shores, R. E., Jack, S. L., Rasmussen, S. K., & Flowers, J. (1995). On the move: Using teacher/student proximity to improve students' behavior. Teaching Exceptional Children, 28, 12-14.

Hastie, P. A. (1993). Task accountability in school physical education and sports settings (Doctoral dissertation, University of Queensland, 1990). Microform Publications, International Institute for Sport and Human Performance, University of Oregon, Eugene, OR, 4093 #74-77.

Hastie, P. A. (1994). Selected teacher behaviors and student ALT-PE in secondary school physical education. Journal of Teaching in Physical Education, 13, 242-259.

Jones, D. L. (1992). Analysis of task systems in elementary physical education classes. Journal of Teaching in Physical Education, 11, 411-425.

Kounin, J. S. (1970). Discipline and group management in classrooms. New York: Holt, Rinehart, and Winston.

McKenzie, T. L., Feldman, H., Woods, S. E., Romero, K. A., Dahlstrom, V., Stone, E. J., Strikmiller, P. K., Williston, J. M., & Harsha, D. W. (1995). Children's activity levels and lesson context during third-grade physical education. Research Quarterly for Exercise and Sport, 66, 184-193.

McKenzie, T. L., Sallis, J. F., Faucette, N., Roby, J. J., & Kolody, B. (1993). Effects of a curriculum and inservice program on the quantity and quality of elementary physical education classes. Research Quarterly for Exercise and Sport, 64, 178-187.

McKenzie, T. L., Sallis, J. F., & Nader, P. R. (1991). SOFIT: System for observing fitness instruction time. Journal of Teaching in Physical Education, 11, 195-205.

Malina, R. M. (1996). Tracking of physical activity and physical fitness across the lifespan. Research Quarterly for Exercise and Sport, 67, 48-57.

Pangrazi, R. (1998). Dynamic physical education for elementary school children. Needham Heights, MA: Allyn and Bacon.

Parsonson, B. S., & Baer, D. M. (1992). The visual analysis of data and current research into stimuli controlling it. In T. R. Kratochwill and J. R. Leaven (Eds.), Single-case research design and analysis: New directions for psychology and education (pp. 15-40) Hillsdale, N.J.: Lawerence Erlbaum Associates.

Patterson, D. L., & van der Mars, H. (2000). The effects of distant interactions on physical activity levels of elementary students during fitness instruction [Abstract]. Research Quarterly for Exercise and Sport, 71, (Supplement) A79.

Rikard, G. L. (1992). The relationship of teachers' task refinement and feedback to students' practice success. Journal of Teaching in Physical Education, 11, 349-357.

Rowe, P. J., Schuldheisz, J. M., & van der Mars, H. (1997). Validation of the SOFIT direct observation instrument for the use with first to eighth grade students. Pediatric Exercise Science, 9, 136-149.

Rowe, P. J., van der Mars, H., Schuldheisz, J. M., & Fox, S. (1997). Measuring physical activity: Validating SOFIT for use with high school students. Paper presented at the 4th. Pacific Rim Conference on Exercise Science and Sports Medicine, Corvallis, OR.

Sallis, J., & McKenzie, T. L. (1991). Physical education's role in public health. Research Quarterly for Exercise and Sport, 62, 124-137.

Sariscsany, M. J., Darst, P. W., & van der Mars, H. (1995). The effects of three teacher supervision patterns on student on-task and skill performance in secondary physical education. Journal of Teaching in Physical Education, 14, 179-197.

Siedentop, D. (1991). Developing teaching skills in physical education. (3rd ed.). Mountain View, CA: Mayfield.

Siedentop, D., & Tannehill, D. (2000). Developing teaching skills in physical education. (4th ed.). Mountain View, CA: Mayfield.

Shephard, R. J., & Trudeau, F. (2000). The legacy of physical education: Influences on adult lifestyle. Pediatric Exercise Science, 12, 34-50.

Summerfield, L. M. (1998, January). Promoting physical activity and exercise among children. ERIC Digest. (Available from Educational Resources Information Center).

Tousignant, M., & Siedentop, D. (1983). A qualitative analysis of task structures in required secondary physical education classes. Journal of Teaching in Physical Education, 3, 47-57.

The President's Council on Physical Fitness and Sports Research Digest (1996). What you need to know about the Surgeon General's report on physical activity and health. Department of Health and Human Services.
Series 2, 6.

U.S. Department of Health and Human Services (1996). Physical activity and health: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

U.S. Public Health Service. (1995). Healthy people 2000 progress report for: Physical activity and fitness. Washington, DC: U.S. Department of Health and Human Services, Public Health Service, Office of Disease Prevention and Health Promotion.

van der Mars, H. (1989a). Basic recording tactics. In P.W. Darst, D. Zakrajsek, & V.H. Mancini (Eds.), Analyzing physical education and sport instruction. (2nd ed.) (pp. 19-51). Champaign, IL: Human Kinetics.

van der Mars, H. (1989b). Observer reliability: Issues and procedures. In P.W. Darst, D. Zakrajsek, & V.H. Mancini (Eds.), Analyzing physical education and sport instruction. (2nd ed.) (pp. 53-80). Champaign, IL: Human Kinetics.

van der Mars, H. (1989c). Teacher monitoring analysis systems. In P.W. Darst, D. Zakrajsek, & V.H. Mancini (Eds.), Analyzing physical education and sport instruction (2nd ed.) (pp. 213-223). Champaign, IL: Human Kinetics.

van der Mars, H., Cusimano, B. E., & Ruppert, K. (1989). Teacher movement analysis system. Technical Report/Software Manual (2nd ed.). Corvallis, OR: Dept. of Exercise & Sport Science, Oregon State University.

van der Mars, H., Vogler, E. W., Darst, P. W., & Cusimano, B. E. (1994). Active supervision patterns of physical education teachers and their relationship with student behaviors. Journal of Teaching in Physical Education, 14, 99-112.

van der Mars, H., Vogler, E. W., Darst, P. W., & Cusimano, B. E. (1998). Students' physical activity levels and teachers' active supervision during fitness instruction. Journal of Teaching in Physical Education, 18, 57-75.

Van Houten, R., Nau, P. A., MacKenzie-Keating, S. E., Sameoto, D., & Colavecchia, B. (1982). An analysis of some variables influencing the effectiveness of reprimands. Journal of Applied Behavior Analysis, 15, 65-83.

Appendices

Appendix A

Forms

OREGON STATE UNIVERSITY
Department of Exercise & Sport Science
Corvallis, OR 97331

Teacher Form

Distant Interaction as a Means for Increasing Physical Activity Levels of Elementary Students

1. Dr. Hans van der Mars, Associate Professor at Oregon State University (OSU) and Debra Patterson, Doctoral Student at OSU has requested my participation in a research study at OSU. The purpose of this study is to examine the effects of distant interaction on students' moderate to vigorous activity (MVPA) levels during physical education class. MVPA levels are typically 65 percent of an individual's maximal heart rate (140 for elementary students).

2. I will be trained in using distant interaction strategies to my students during the fitness portion of the physical education lesson.

   One trained observer (OSU Exercise and Sport Science graduate student) will systematically observe the classes. The observer will use a portion of the System for Observing Fitness Instruction Time (SOFIT) instrument. The SOFIT instrument quantifies levels of physical activity of students from an intensity perspective. It has been validated in previous research. Students will not be informed of the SOFIT instrument until completion of all data collection. While the observer will assist in data collection, only the researchers will have access to the data; identification codes will be established for the teachers and students. Neither the teachers nor the students will be referred to by name during the research or publication process.

   I am also aware that I will be videotaped for the purpose of verifying the experimental condition while teaching the fitness portion of the lessons. The videotape will only be watched by myself and the observer from OSU. The videotape will not be for public display and will be erased after the completion of the study.

3. There are no foreseeable risks associated with this study. I do understand that I will be asked to use distant interaction strategies, wear a microcassette recorder with a prerecorded audio cue, as well as, wear a wireless microphone during lessons when data are collected.

4. While I will not receive tangible benefits (e.g., remuneration) for participation, I will gain an understanding of the use of distant interaction as it relates to actively supervising students. Furthermore, I realize that the resulting data will add to a knowledge base on teachers' accountability systems and its relationship to physical activity levels of elementary school-aged children.

INFORMED CONSENT FORM
Page 2

5. I understand that the results of the research study may be published but that my name or identity will not be revealed. In order to maintain confidentiality, Dr. van der Mars and Ms. Patterson will utilize a coding system that identifies me only by a code. Only Dr. van der Mars and Ms. Patterson will have access to this confidential information which will be kept on file in a secure location in the Instructional Analysis Laboratory in the College of Health & Human Performance at Oregon State University.

6. I have informed Dr. van der Mars and Ms. Patterson that I have no documented medical condition that might pose a risk for participation in this study.

7. I have been informed that I will not be compensated for participation in this study.

8. I have been advised that the research in which I will be participating does not involve more than the normal risk involved in teaching in a regular physical education setting.

9. I have been informed that any questions I have concerning this research project, before or after my consent, will be answered by Dr. van der Mars (phone 541/737-4649) or Ms. Debra Patterson (phone 541/737-5932).

10. I understand if I have questions about my rights as a participant in this research project I can contact Mary Nunn (phone 541/737-0670).

11. I have read the above informed consent. The nature, demands, possible risks, and benefit(s) of the project have been explained to me. I knowingly assume the risks involved, and understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to me. A copy of this consent form will be given to me.

Teacher's Signature_____ Date _____

I, Hans van der Mars or Debra Patterson certify that I have explained to the above individual the nature and purpose, the potential benefit(s), and possible risks associated with participation in this research project, have answered any question that have been raised, and have witnessed the above signature and have provided the participant a copy of this signed consent document.

Signature of On-site Investigator_____ Date _____
(Hans van der Mars or Debra Patterson)

OREGON STATE UNIVERSITY
Department of Exercise & Sport Science
Corvallis, OR 97331

Parent Form

Distant Interaction as a Means for Increasing Physical Activity Levels of Elementary Students

1. Dr. Hans van der Mars, Associate Professor at Oregon State University (OSU) and Debra Patterson, Doctoral Student at OSU, have requested my child's participation in a research study. The title of the research is " The effects of distant interaction on physical activity levels of elementary students.

2. I have been informed that the purpose of this research is to measure students' physical activity levels by the use of systematic observation, that is, directly observing physical activity levels during the fitness portion of their regular physical education class. The class will be videotaped, primarily to observe the teachers' interactions with the students. The videotape will only be watched by the physical education teacher at my child'school and the observer from OSU. The videotape will not be for public display and will be erased after the completion of the study. I will not discuss the specific purpose of this project with my son/daughter so as not to influence his/her conduct during class.

3. My child's participation will involve performing regular physical activity tasks during his or her regular physical education class.

4. There are no foreseeable risks or discomforts.

5. Students will participate in regular scheduled physical education class but will not be used as target participants in the study.

6. I understand that the possible benefits of my child's participation in the research are the increase of lifetime physical activity that will hopefully carry over into healthy behavior patterns during adulthood.

7. I understand that the results of the research study may be published but that my child's name or identity will not be revealed. In order to maintain confidentiality, Dr. van der Mars and Ms. Patterson will utilize a coding system that identifies my child only by a code. Only Dr. van der Mars and Ms. Patterson will have access to this confidential information, which will be kept, on file in a secure location in the Instructional Analysis Laboratory in the College of Health & Human Performance at Oregon State University.

8. I understand that the research in which my child will be participating does not involve more than minimal risk.

9. I understand that I will not be compensated for my child's participation.

INFORMED CONSENT FORM
Page 2

10. Any questions I have concerning this research project, before or after my consent, will be answered by Dr. van der Mars (phone 541/737-4649) or Ms. Debra Patterson (phone 541/737-5932).

11. The physical education teacher and the Elementary School administration are aware of any documented medical conditions for my child that might pose a risk for participation in this study.

12. I have been informed that any questions I have concerning this research project, before or after my consent, will be answered by Dr. van der Mars (phone 541/737-4649) or Ms. Debra Patterson (phone 541/737-5932).

13. I understand if I have questions about my rights as a participant in this research project I can contact Mary Nunn (phone 541/737-0670).

14. I have read the above informed consent. The nature, demands, possible risks, and benefit(s) of the project have been explained to me. I knowingly assume the risks involved, and understand that my I may withdraw my consent and discontinue my child's participation at any time without penalty or loss of benefit to me or my child. A copy of this consent form will be given to me.

Parent's Signature_____ Date _____

I, Hans van der Mars or Debra Patterson certify that I have explained to the above individual the nature and purpose, the potential benefit(s), and possible risks associated with participation in this research project, have answered any question that have been raised, and have witnessed the above signature and have provided the participant a copy of this signed consent document.

Signature of On-site Investigator_____ Date _____
(Hans van der Mars or Debra Patterson)

OREGON STATE UNIVERSITY
Department of Exercise & Sport Science
Corvallis, OR 97331

Child Assent Form

Distant Interaction as a Means for Increasing Physical Activity Levels of Elementary Students

I, _____, understand that my parents (mom and dad) gave permission (said it was okay) for me to take part in a project about being physically active (exercising) during the fitness activity in my regular physical education classes at my school over the past __ weeks. I may have been observed by an outside observer during those regular classes. I give permission for that information to be used. The project was done by Debra Patterson and Hans van der Mars from Oregon State University.

_____

Signature

SOFIT Observation Form 99-00

Date: _____ School: Aloha Seaside Grade: ____ Teacher: _____
Time Start:_____ Observer_____ Fitness Length _____
Condition: A B C Fitness Activity:

Intervals	MVPA Yes/Total # of Students at Station				**Sector Space (Student)**	Teacher Prompt
	Close	**St.S.**	**Tr.Prom.**	**Distant**		
:10	/	___	_____	/	___	_____
:20	/	___	_____	/	___	_____
:30	/	___	_____	/	___	_____
:40	/	___	_____	/	___	_____
:50	/	___	_____	/	___	_____
1:00	/	___	_____	/	___	_____
:10	/	___	_____	/	___	_____
:20	/	___	_____	/	___	_____
:30	/	___	_____	/	___	_____
:40	/	___	_____	/	___	_____
:50	/	___	_____	/	___	_____
2:00	/	___	_____	/	___	_____
:10	/	___	_____	/	___	_____
:20	/	___	_____	/	___	_____
:30	/	___	_____	/	___	_____
:40	/	___	_____	/	___	_____
:50	/	___	_____	/	___	_____
3:00	/	___	_____	/	___	_____
:10	/	___	_____	/	___	_____
:20	/	___	_____	/	___	_____
:30	/	___	_____	/	___	_____
:40	/	___	_____	/	___	_____
:50	/	___	_____	/	___	_____

Teacher Verification Form 99-00
Date: _____ School: _____ Grade: ____ Teacher: _____
Time Start:_____ PE TCHR_____ Fitness Length _____
Condition: B = Close Prompts C = Distant Prompts Fitness Activity:

Intervals		Sector Teacher Is In	Correct Prompt For Condition Y/N
First Half of Class 1:00 Minute Mark			
1.	1:10	___	_____
2.	1:20	___	_____
3.	1:30	___	_____
4.	1:40	___	_____
5.	1:50	___	_____
6.	2:00	___	_____
7.	2:10	___	_____
8.	2:20	___	_____
9.	2:30	___	_____
10.	2:40	___	_____
11.	2:50	___	_____
12.	3:00	___	_____
Second Half of Class 5:00 Minute Mark			
1.	5:10	___	_____
2.	5:20	___	_____
3.	5:30	___	_____
4.	5:40	___	_____
5.	5:50	___	_____
6.	6:00	___	_____
7.	6:10	___	_____
8.	6:20	___	_____
9.	6:30	___	_____
10.	6:40	___	_____
11.	6:50	___	_____
12.	7:00	___	_____

7	4	1
8	5	2
9	6	3

SOFIT Teacher Behavior Observation Form 99-00

Date: _____ School: Aloha Seaside Grade: ___Teacher:_____
Time Start:_____ Observer_____ Fitness Length _____
Condition: A-Baseline Close Distant Fitness Activity:

Intervals	Teacher Behavior	Sector Space	Notes
:10	P D I M O T	___	
:20	P D I M O T	___	
:30	P D I M O T	___	
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:50	P D I M O T	___	
1:00	P D I M O T	___	
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:50	P D I M O T	___	
2:00	P D I M O T	___	
:10	P D I M O T	___	
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:50	P D I M O T	___	
3:00	P D I M O T	___	
:10	P D I M O T	___	
:20	P D I M O T	___	
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4:00	P D I M O T	___	

Appendix B

Review Of Literature

Review of the Literature

The focus of this study was to examine the effects of distant interactions on physical activity levels of elementary students during physical education. The purpose of this review of the literature is to provide an overview of published research in the area of physical activity and active supervision as it pertains to elementary physical education. The review will focus on the benefits of physical activity, the lifetime physical activity model, and research on teaching associated with the promotion of physical activity towards children. The research will provide a strong rationale for promoting physical activity. The strengths and weaknesses of the research will be described. The review of literature will provide a foundation and purpose for this present study.

Benefits of Physical Activity

With sedentary lifestyles increasing on a daily basis, many professionals are concerned that children growing up in today's society of technology may not be active enough for current or future health benefits (Biddle & Goudas, 1996; USDHHS, 1996). Recently, the first ever, Surgeon General's report on physical activity took a bold stand at linking physical activity to numerous health improvements (USDHHS, 1996). The report emphasized that physical activity can help reduce the risk of chronic diseases such as coronary artery disease, diabetes, hypertension, and colon cancer. Other benefits associated with physical activity include improved mental health and

a better quality of life in aging adults. The Surgeon General made a public health challenge to fight off sedentary lifestyles and improve the current level of physical activity among the general population. The report also included many recommendations for accomplishing this task. One of the recommendations addresses schools as one of the strongest avenues to educate children about the benefits of lifetime physical activity. It specifically stated that findings from the School Health Policies and Program Study found that school-based physical education programs may be the most important resource for promoting physical activity. The downside of the School Health and Policy Study is that after a nationwide survey, the amount of physical education required for students is not enough to meet the national objectives in Healthy People 2000. Additionally, it was reported that instructional practices in physical education do not emphasize lifetime physical activity and that insufficient class time is actually being spent engaging in physical activity.

Further recommendations from the Surgeon General's report stress intervention programs that target elementary physical education programs, specifically aimed at increasing the amount of physical activity engagement time. Targeting the elementary aged children is important since there has been an increased amount of research concerning the relationship of children's physical activity patterns and the carry over of these patterns into adulthood (Sallis, McKenzie, & Alcaraz, 1993; Sallis & McKenzie, 1991; Malina, 1996; Corbin & Pangrazi, 1998; Shephard & Trudeau, 2000).

Taking on the responsibility of promoting physical activity should include both public health and school professionals. Sallis & McKenzie (1991) published a study

that analyzed the contributions of physical education to the health of children and adults. It also looked at how physical educators and health professionals viewed the effects of physical education on health variables. The authors reported on the benefits of physical activity, current levels of physical activity for children, and the current status of elementary physical education programs. One of the most important points made was that elementary schools should emphasize health related physical activity that will carry over into adulthood and will ultimately, reduce the risk factors of cardiovascular disease. The authors conducted a survey of other studies that researched health related physical education programs. They concluded that when a school's physical education program focused on health related physical activity, children's activity levels increased, as well as, risk factors for cardiovascular disease decreased. There was an important recommendation that health programs that focus on behavior change should contain physical education components to ensure success. Additionally investigated, was the types of physical activity children should be engaged in. Moderate intensity activities were found to be maintained over time versus vigorous intensity activities. Therefore, moderate intensity activities should be emphasized in elementary physical education programs. This demonstrates the need for physical education programs to shift the focus from physical fitness to health related physical activity.

A nationwide study that investigated children's activity levels and lesson context during third grade physical education (McKenzie, Feldman, Woods, Romero, Dahlstrom, Stone, Strikmiller, Williston, & Harsha, 1995) found that children are not

physically active enough during physical education to ensure health benefits associated with physical activity. The authors examined different areas of the lesson to see where children were most physically active. The SOFIT (System for Observing Fitness Instruction Time; McKenzie, Sallis, & Nader, 1991) instrument was used to code activity levels. The fitness context of the lesson was found to include more physical movement than other lesson contexts. To meet the objectives of Healthy People 2000 (USPHS, 1995) children aged 6 years and older should engage in light to moderate physical activity for at least 30 minutes per day and vigorous activity for 20 minutes or more 3 days per week for a total of 270 minutes of MVPA per week. The authors reported that children were very active only 17.5% and MVPA categories only 36.2% of the lesson time. It was additionally noted that even if schools scheduled and planned for 90 minutes of physical education per week, children would be very active only 26.3% and MVPA would only be 12.1%. This is well below what is needed for health benefits. It was further discussed that if schools are to be the primary place to promote physical activity more time must be set aside for longer class periods and other activity experiences during recess, before and after school. This study discussed the need for more time, but realistically, this would be difficult with the ever-increasing demands on other curricular areas. This study provides evidence that better instructional strategies must occur in order to provide children more opportunities to increase their physical activity levels. A downside to this study was that it looked at curricular context, but lacked to investigate instruction and supervision areas as a way to combat the low levels of physical activity in physical education programs.

Lifetime Physical Activity Model

Based on the Surgeon General's report on physical activity, Corbin and Pangrazi (1998) were the primary authors in providing a statement of guidelines for children's physical activity levels. The authors brought to point that exercise models used to predict the appropriate amounts of physical activity are based off data from adults. This report is specifically presented to state guidelines designed to address the needs of children. The authors discussed the use of the Exercise Prescription Model and how its primary use is for athletic performance. The guidelines recommend the Lifetime Activity Model (LAM) which is used to determine physical activity levels for adults, but can be modified for children. The LAM states that moderate activity accumulated over time in a given week will provide enough energy expenditure to produce health benefits.

One of the interesting recommendations made by Corbin and Pangrazi is that they address specific guidelines that focus on the school and physical education. The school as the primary place to promote physical activity is mentioned and that schools have the responsibility to provide experiences that "turn on" children to the benefits of physical activity. Several recommendations include a positive environment, individualized activities, and exposure to a variety of physical activities. A bold statement was made that schools should focus on the process of physical activity versus the product. Too often the product is focused on. This is were students must be the fastest, produce a certain number of tasks, and attempt difficult tasks that may be beyond the genetic makeup of most children. The process emphasizes children to try their best, participate regularly, and be involved in lifetime physical activity. The

statement of guidelines specifically states that instructional feedback and encouragement should focus on the process, not the product. This document provides a strong foundation for this present study on distant interaction. It is important to investigate instructional strategies that provide children encouragement during physical activity.

Measuring Physical Activity

There are a variety of methods to measure physical activity levels. Several examples include heart rate monitors, self-report questionnaires, direct observation, motion sensors, and interviews (McKenzie, Sallis, & Nader, 1991). The use of direct observation has benefits over the other methods in that when it is accompanied by the use of videotape and a validated systematic instrument, results can be accurate and easily interpreted (McKenzie, Sallis, & Nader, 1991).

Systematic Observation has been used in other fields for many years (van der Mars, 1989). Recently, it has been widely accepted for its contribution in the field of physical education. Educators and researchers use systematic observation to assess many different facets of physical activity. McKenzie, Sallis, and Nader (1991) developed an instrument "The System for Observing Fitness Instruction Time" (SOFIT) for assessing children's physical activity levels through direct observation. The SOFIT instrument quantifies levels of physical activity of students from an intensity perspective. It has also been used in research to observe and measure teacher positioning and student activity levels. It has been validated for use with elementary

students and middle school students in previous research (McKenzie, Sallis, & Nader, 1991; Rowe, Schuldheisz, & van der Mars, 1997).

Research on Teaching Physical Education

The foundation for most of the research on teaching in physical education comes from research in the classroom. Doyle (1979; 1986) thoroughly investigated the use of active supervision in the classroom. To provide an understanding of how classrooms operate he developed an ecology of teaching model. He identified two major task systems: order and learning. Each of these tasks interacts with each other to make up the teaching-learning process.

Tousignant and Siedentop (1983) expanded on Doyle's ecology of teaching model and applied it to the physical education setting. The managerial tasks are those tasks teachers use to organize their students and other nonsubject duties associated with teaching such as getting equipment, establishing rules, and moving from one place to another. The instructional task system is where learning takes place through instruction, prompting, and feedback. The student-social tasks involve student interactions and can be dictated by the student during class time towards the managerial and instructional tasks. Tasks are broken down into four components: a) the goal to be achieved, b) procedures to achieve the goal, c) resources available to achieve the goal, and d) accountability for achieving the goal (Doyle, 1985). Accountability measures are strong indicators for the importance or significance of the task or goal.

An additional aspect of monitoring involves teacher proximity. Most of the research on teacher proximity has been performed in the classroom (Gunter, Shores, Jack, Rasmussen, & Flowers, 1995; Van Houten, Nau, MacKenzie, Sameoto, & Colavecchia, 1982). It has been found that students exhibit more on task behavior when the teacher is in close proximity.

One study in particular (Gunter et al., 1995) found that when teachers moved throughout the room, students increased their academic engagement independently as compared with the teacher maintaining a fixed position. Most of the research has looked at the effects of teachers providing feedback or reprimands at a close proximity of 3-10 ft. Van Houten et al. (1982) found that students with behavior issues maintained more on task behavior when the teacher was in a 3 ft radius as compared to 21 ft radius. Gunter et al. found that when teachers were within 10 feet of the students they more than doubled their praise and feedback resulting in lower numbers of students disruptions. Hastie (1990) investigated the use of active instruction by the looking at the use of monitoring and stated that students had higher levels of involvement in physical education when the teacher was in close proximity. He further found that the accountability factor of monitoring had a direct effect on students valuing the teacher during physical education classes. An additional study by Hastie (1994) found that effective teachers were ones who spent more time intervening with the students versus the ones who were noninteractive and spent more time observing students. The results indicated that students were held more accountable with effective teachers.

Jones (1992) described and analyzed the use of task systems during elementary physical education. Systematic observation strategies were used to analyze the tasks. One of the purposes of the study was to determine the different types of accountability systems and how they operate in elementary physical education. Since there are no formal exchange of performance for grades, the author investigated how elementary physical education teachers kept their students on-task during lessons. The findings indicated that during the instructional tasks, teachers' response to student behavior included various forms of monitoring. The monitoring included providing feedback, individualized instruction, and modifying and adjusting tasks. During the social task, teachers' interactions included learning names, and physical displays of approval. Accountability was further reinforced through the use of praise and positive approval for appropriate students' behavior.

It was determined that all three tasks systems interact with one another during physical education. Accountability was mainly established through teacher supervision and monitoring. This was important because it kept students' on-task whether they were successful or not and knowing that there was no formal exchange of a grade for their effort and performance. This study parallels previous research on task systems in physical education. It also reinforces the importance of accountability as being significant in promoting student learning. While this study provided more evidence on the importance of accountability and supervision, there still appears to be a lack of information regarding the effects of teacher supervision and monitoring in keeping students' physically active during the fitness portions of elementary physical education.

An additional study that focused on the relationship of teachers' task refinement and feedback to students' practice success was performed by Rikard (1992). The author wanted to verify previous studies that concluded that teacher feedback was important for developing student accountability. The study gathered information on two introductory motor skills performed by a low-skilled group and a high-skilled group. The use of feedback during instruction was examined to verify task improvement. The results indicated that both the low-skilled group and the high-skilled group experienced about the same amount of success regardless of the task or feedback. These results occurred due to the lack of appropriate skill tasks and time spent chasing the balls for the low-skilled group, while the high-skilled group was inconsistent with their practice because of assisting peers or missing rotations. The findings indicate a need for additional research with larger sample size to examine the possible relationships of feedback and student success. While this study concluded no significant differences between groups during skill acquisition there is a need to investigate the use of feedback and monitoring to hold students accountable during different lesson contexts. This study lacked a thorough look at additional strategies used by effective teachers.

Active Supervision

A study by Sariscsany, Darst, and van der Mars (1995) investigated the effects of three teacher supervision patterns on student on-task and skill performance in middle school. The study used three target students and three experienced physical education teachers' as subjects. The teachers' provided three types of supervision

patterns while teaching a two week volleyball skills unit. The supervision patterns included: a) close supervision with feedback, b) distant supervision with feedback, and c) distant supervision with no feedback. The gymnasium was sectioned off into nine equal sized areas to ensure the proximity required for each of these conditions. The teachers' were instructed to provide feedback at a rate of 0.5 per minute. These interactions were observed during the station format during the lesson for approximately 10-15 minutes.

Results indicated that the two active supervision patterns produced higher results for on-task performance with two out the three target students. However, the authors noted, due to the limited replications of appropriate skill practice, the two patterns of active supervision may not be strong enough to produce consistent results with skill practice. What came into question, was the lack of knowledge that is known in regards to understanding how students' interpret the feedback and how the timing of feedback effects performance. It was further noted that two weeks was not an adequate amount of time to teach complex skills, yet this is a common practice in secondary physical education. This study provides evidence that active supervision and teacher positioning can be used as a means to increase students' on-task participation during skill units. Again, the area of fitness and the effects of active supervision on students' physical activity levels have yet to be addressed.

Additional research that investigated active supervision patterns of elementary physical education teachers and their relationship with student behaviors was conducted by van der Mars, Vogler, Darst, and Cusimano (1994). The purpose of their study was to develop a descriptive database on different dimensions of teachers'

active supervision behavior. A second purpose investigated the relationship between teachers' active supervision and students' performance behavior. The subjects included 18 elementary physical education teachers and 54 target students' from grades first through sixth. All teachers' taught from the same curriculum. The curriculum focused on teaching the process of being physically active as opposed to the outcome. Teachers' movement patterns and verbal feedback with the target students' were videotaped during one 30-minute lesson. The gymnasium floor was taped off into nine sectors to aid in observing teachers' movement patterns. The study looked at five specific types of feedback and four areas of student involvement. Event recording and frequency counts were used to collect data from the feedback, while interval recording was used for the student behavior data.

The findings indicated that teachers' spent 88% of their time around the peripheral sectors of the gymnasium. Teacher movement around the periphery correlated with the student's total engagement in motor tasks and successful motor tasks. The authors did not find a positive relationship between teacher movement and verbal feedback as was expected. It was reported that only behavior feedback correlated with teachers' movement. The amount of movement needed to teach effectively is unknown. The specific area of the lesson being taught may have a direct influence on how much movement is required by the teacher and what type of feedback would be most advantageous. The authors did find that teachers actively supervised their students, which had a positive influence on students' motor engagement. Although this study looked at teachers' supervision patterns and several types of feedback, the focus was on the entire lesson as a whole. It would be

beneficial to look at each section of the lesson individually and take into account the different rates of movement and feedback associated with specifics of certain sections of the lesson.

A study performed by van der Mars, Vogler, Darst, & Cusimano (1998) investigated the relationship between physical education teachers' patterns of active supervision and students' physical activity levels during fitness instruction. The active supervision patterns of 18 elementary physical education teachers and 3 randomly selected students per teacher. Direct observation was used along with the SOFIT instrument to measure the students' physical activity levels. The gym was divided into (3 X 3) sectors to aid in coding. Teacher time and movement rates were calculated with the teacher movement analysis system (TMAS; van der Mars, Cusimano, & Ruppert, 1998) software. Teachers' verbal behavior was collected using a variety of categories specifying the type of feedback. The results indicated that the teachers employed active supervision by actively moving around the peripheral of the gym (90%) and throughout the sectors (7.9 sector changes per minute), and provided verbal feedback to students at a rate of 3.7 per minute. There was a correlation with increased levels of MVPA by the students when the teachers actively moved and demonstrated throughout instruction. This study further indicates the need and usefulness for teachers to employ active supervision strategies throughout their lessons. A limitation associated with this study is that it only looked at the 18 physical education teachers for one lesson and only used 3 students to measure MVPA.

A recent study by Patterson & van der Mars (2000) provided further investigation on the effects of distant interaction on elementary students' during fitness instruction. The purpose of this study was to determine a functional relationship between distant interactions by an elementary physical education teacher on elementary students' moderate to vigorous physical activity levels during fitness instruction. Distant interactions were defined as teacher verbal prompts, encouragement, and feedback provided to students located on the opposite ends of the gym from where the teacher is located. Fifty-eight students from two fourth grade classes and one elementary physical education teacher were observed for this study. A modified reversal design using two treatments, close interaction and distant interaction over three phases was implemented. A modified System for Observing Fitness Instruction Time (SOFIT) and "live" momentary time sampling was used to measure students' MVPA during fitness instruction. The teachers' interactions were observed and coded using SOFIT's teacher behavior categories. The instructional format was held constant throughout the study (i.e., station format), while activity tasks at each station varied across lessons. Classes were videotaped to monitor fidelity of treatment and interobserver agreement (IOA). The gym floor was sectioned off using the same protocol as in the van der Mars, Vogler, Darst, and Cusimano (1994) study. Students' mean MVPA levels and teacher interaction behavior data were plotted graphically, and analyzed visually, using data overlap and variability between conditions, level changes from one condition to the next, and trends within and across conditions as criteria.

The means for the students' MVPA data yielded the following results. During both phases of C-IA, Chris's class mean was 68%, while 76% for the D-IA phase. Sandy's class means were 75% and 80% for the D-IA phases and 67% for the C-IA phase. Furthermore, data path trends changed in hypothesized direction upon change in condition. These findings build further the empirical base of teachers' active monitoring behavior and point to the importance of teachers distributing their attention to all areas of the gymnasium during fitness instruction. That is, teachers need to be aware of the benefits of using distant interactions to increase/sustain students' MVPA during fitness instruction as part of the process aimed at shaping physical activity behavior in youth. Several limitations of this study included the use of only one teacher and one grade level of students.

Summary

There is a significant amount of information on the benefits of physical activity and the thinking that elementary schools should be the primary place to promote physical activity. This places the responsibility on the physical education programs. Both curriculum and instruction must make the shift from focusing on the product towards teaching the process of lifetime physical activity. Recent research has provided the Lifetime Physical Activity Model as a valuable tool to utilize in working with children. As research has demonstrated, the challenge is in providing effective instructional strategies that promote physical activity. Most of the research investigated different instructional strategies and their effect on skill acquisition. What is lacking is research that examines specific instructional strategies that focus

on supervision and interactions by the physical education teacher during the fitness component of the lesson. Research has demonstrated that holding students' accountable during class increases their on-task behavior. If the goal is educate children to include lifetime physical activity, then it is imperative that educators develop ways of "turning on" the student to understanding and appreciating the value of physical activity.

Appendix C

Institutional Review Board Approval

OREGON STATE
UNIVERSITY

Report of Review by the Institutional Review Board for the Protection of Human Subjects

TO: Hans van der Mars, ExSS

COPY: Debra L. Patterson, ExSS

RE: Distant interaction as a means for increasing physical activity levels of elementary students.

The referenced project was reviewed under the guidelines of Oregon State University's Committee for the Protection of Human Subjects and the U.S. Department of Health and Human Services. The committee has **approved** your application. The approval of this application expires upon the completion of the project or one year from the approval date, whichever is sooner. The informed consent form obtained from each subject should be retained in program/project's files for three years beyond the end date of the project.

Any proposed change to the protocol or informed consent form that is not included in the approved application must be submitted to the IRB for review and must be approved by the committee before it can be implemented. Immediate action may be taken where necessary to eliminate apparent hazards to subjects, but this modification to the approved project must be reported immediately to the IRB.

Date: 07/29/99

Warren N. Suzuki, Chair
Committee for the Protection of Human Subjects
(Education, 7-6393, suzukiw@orst.edu)